REMARKS

Claims 8–11, 16–19, 24–27, 32–35, and 40 are pending in this application. By this Amendment, claim 8 is amended to further distinguish over the reference cited in the Office Action.

No new matter is added. Support for the amendments to claim 8 may be found, for example, in the specification as originally filed at, for example, page 13, line 23 to page 14, line 7.

Applicants appreciate the courtesies shown to Applicants' representative by Examiners Rodgers and Smoot in the May 31, 2007 interview. Applicants' separate record of the substance of the interview is incorporated into the following remarks.

Entry of the amendments is proper under 37 CFR §1.116 since the amendments: (a) place the application in condition for allowance for the reasons discussed herein; (b) do not raise any new issue requiring further search and/or consideration as the amendments amplify issues previously discussed throughout prosecution; and (c) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented because the amendments are made in response to arguments raised in the final rejection, and arguments made by the Examiners during the May 31, 2007 interview. Entry of the amendments is thus respectfully requested.

In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

I. Rejection Under 35 U.S.C §103(a)

Claims 8–11, 16–19, 24–27, 32–35 and 40 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 6,372,609 to Aga et al. Applicants respectfully traverse the rejection.

Aga et al. fails to teach or suggest a method of producing an SOI wafer having a buried oxide film with a thickness of less than 100 nm, forming an oxide film having a thickness of 100 nm or more on a surface of at least one of a bond wafer and a base wafer, bonding the bond wafer to the base wafer through the formed oxide film, and making the bond wafer into a thin film, wherein after the oxide film is formed so that the total thickness of the oxide film formed on the surface of at least one of the bond wafer and the base wafer is thicker than a thickness of the buried oxide film that the SOI wafer to be produced has, the bond wafer is bonded to the base wafer through the formed oxide film, the bond wafer is made into a thin film to form an SOI layer, and thereafter, an obtained bonded wafer is subjected to heat treatment to reduce the thickness of the buried oxide film, and the thickness of the buried oxide film is reduced to less than 100 nm as required in amended claim 8.

The Patent Office acknowledges that Aga et al. does not specifically disclose that the thickness of the buried oxide film is reduced to 100 nm or less by heat treatment. The Patent Office asserts that the claims are *prima facie* obvious, allegedly because (1) Aga et al. describes "the identical processing method as instantly claimed," and (2) there is no evidence of record showing that the claimed buried oxide film thickness achieves unexpected results. Applicants respectfully disagree.

First, contrary to the allegations of the Patent Office, Aga et al. does not teach or suggest an identical processing method as that recited in claim 8. Aga et al. fails to teach or suggest applying an oxide film having a total thickness of 100 nm or more that is greater than the thickness of the buried oxide film to be produced (i.e., less than 100 nm), and fails to teach or suggest a heat treatment that reduces the thickness of the buried oxide film to less than 100 nm.

Aga et al. discloses a method of producing an SOI wafer, wherein a base wafer 1 and a bond wafer 2 are prepared (step A); an oxide film 3 is formed on the surface of the bond

wafer 2 (step B); the base wafer 1 is superposed on the bond wafer 2 via the oxide film (step D); a delamination wafer 5 is delaminated from an SOI wafer 6 (step E); and a bonding heat treatment is performed so that the bonding between the wafers of the SOI wafer 6 is further strengthened (step F). See col. 5, line 50 – col. 6, line 33 of Aga of et al.

Aga et al. fails to disclose a step in which the oxide film is formed so that a total thickness of the oxide film formed on the surface of at least one of the bond wafer and the base wafer is 100 nm or more and is thicker than a thickness of the buried oxide film that the SOI wafer to be produced has, as recited in claim 8. Aga et al. also fails to disclose a step of heat treatment to reduce the buried oxide film thickness to less than 100 nm.

That is, claim 8 of the present application must meet the condition in the step of forming the oxide film as follows:

(thickness of the buried oxide film that the SOI wafer to be produced has) < (thickness of the oxide film formed on a wafer in the step of forming the oxide film).

However, Aga et al. does not describe such a step at all. The difference in claim 8 in which the oxide film is formed beforehand so that the oxide film has a thickness of 100 nm or more and is thicker than the desired thickness of the buried oxide film and Aga et al. in which such a step is not described provides a remarkable difference in effects when the production of an SOI wafer having a buried oxide film with a thickness of less than 100 nm is attempted.

Problems arise in an SOI wafer having a thin (less than 100 nm) buried oxide film according to Aga et al. because an oxide film initially formed on the bond wafer must have a thickness equal to the thin buried oxide film because the thin buried oxide film is not reduced as in the present claims. As a result, problems, such as blisters and voids tend to be generated in a delaminating heat treatment conventionally producing an SOI wafer having the thin (less than 100 nm) buried oxide film (see FIG. 3, page 4, line 22 to page 5, line 22, page 11, lines 17-25 and Comparative Examples 1 and 2 in Table 1 of the present specification).

In order to solve such problems, the present application discloses that when producing an SOI wafer by a bonding method, after an oxide film is formed so that the thickness of the oxide film is 100 nm or more and is thicker than the thickness of the buried oxide film that the SOI wafer to be produced has, the wafers are bonded to each other and the bond wafer is made into a thin film to form an SOI layer. Thereafter, an obtained bonded wafer is subjected to heat treatment, and the thickness of the buried oxide film is reduced to less than 100 nm as recited in claim 8. Thereby, such an SOI wafer can be produced so that blisters and voids are not generated in it. As a result, such an SOI wafer exhibits these especially remarkable effects (avoidance of blister and voids) are exhibited by such an SOI wafer that has a thin (such as less than 100 nm) buried oxide film. Moreover, the SOI layer exhibits good crystallinity (see page 6, lines 24 to page 7, line 16 in the present specification).

The method of the present application thus requires forming an oxide film so that the oxide film has a thickness of 100 nm or more in which blisters and voids are hard to be generated in delaminating heat treatment, then, after a delaminating heat treatment step, the thickness of the buried oxide film is reduced to less than 100 nm. These steps for producing an SOI wafer are not taught or suggested by Aga et al., and Aga et al. thus does not teach the same processing conditions, contrary to the Patent Office's assertion. In this regard, the bonding heat treatment in Aga et al. is short (only two hours at most - see col. 6, lines 31-33 of Aga et al.), and such is insufficient to reduce the thickness of a buried oxide film from 100 nm (thickness of an oxide film initially formed on bond wafer) or more to less than 100 nm as required in claim 8. As will be further detailed below, the bonding heat treatment in Aga et al. thus fails to satisfy the buried oxide layer thickness reduction requirements of the heat treatment step claimed.

By the method recited in claim 8, an SOI wafer having a buried oxide film with a thickness of less than 100 nm exhibits a dramatic decrease in occurrences of blisters and

voids as compared to conventional SOI wafers that also require the oxide film formed on the bond wafer to have a thickness of less than 100 nm. Thus, also contrary to the Patent Office's assertions, the present method achieves unexpected results. These results are confirmed in Examples 1 and 2 as compared to Comparative Examples 1 and 2 in the present specification. As shown in Table 1 of the present specification, the Comparative Examples 1 and 2, prepared without a formed oxide film having a thickness of 100 nm or more as recited in claim 8, develop blisters and voids. Comparative Examples 1 and 2 are representative of the results that would be obtained following the teachings of Aga et al., which does not including reducing the buried oxide film to less than 100 nm. The Examples 1 and 2 show unexpected reduction of such defects.

Further, Aga et al. fails to even address the problem that the present application addresses. Specifically, Aga et al. fails to address that "when the production of an SOI wafer having a buried oxide film with a thickness of 100 nm or less is attempted, blisters and voids tend to be generated in delaminating heat treatment" (see page 11, lines 16-24 in the present specification). Still further, nowhere does Aga et al. teach or suggestion a solution to this problem, such as forming an oxide film with a thickness of 100 nm or more and reducing the thickness of the buried oxide film to less than 100 nm.

Because this problem is not taught or suggested by Aga et al., one of ordinary skill in the art would not have derived the novel method of claim 8 from the teachings of Aga et al., and would not have found the above results of the present method to have been expected.

Moreover, the SOI wafer of Aga et al. includes the buried oxide layer 3 that has a thickness of 700 nm (see column 9, lines 54-57 of Aga et al). Even if an SOI wafer having a buried oxide film with a thickness of less than 100 nm is produced in a method described in Aga et al., the problem that blisters and voids tend to be generated in delaminating heat treatment after bonding of the wafers still occurs. The problem of blisters and voids still

occurs because the bonding heat treatment of Aga et al. is performed only for 30 minutes to 2 hours. Even if the bonding heat treatment is performed for such a short period of time, the reduction amount of the thickness of the buried oxide film is extremely small and would fail to reduce the thickness of the buried oxide film from 100 nm or more (thickness of the formed oxide film) to less than 100 nm.

On the contrary, heat treatment to reduce the thickness of the buried oxide film to less than 100 nm, as required in claim 8, is performed for, for example, from about 4 hours to about 14 hours in the present method (see Table 1 in the present specification). Thus, the bonding heat treatment of Aga et al. is not the same as or even substantially similar to the heat treatment for reducing the thickness of the buried oxide film to less than 100 nm as set forth in claim 8.

As described at page 26, lines 5-11 of the present specification, a bonding heat treatment to further increase the bonding strength between the bond wafer and the base wafer can be performed in the present method. This confirms the distinction between the bonding heat treatment of Aga et al. and the heat treatment for reducing the thickness of the buried oxide film to less than 100 nm as recited in claim 8.

For all the foregoing reasons, producing an SOI wafer according to the recited method of claim 8 is clearly different than the method of Aga et al. which discloses producing an SOI wafer by a different method and wherein the thickness of the buried oxide layer is thick (such as 700 nm).

Because the features of independent claim 8 are not taught or suggested by Aga et al., Aga et al. would not have rendered the features of claim 8 obvious to one of ordinary skill in the art. Furthermore, the assertion by the Office Action that the claimed range of thicknesses for the buried oxide film is *prima facie* obvious is incorrect, and is further rebutted by evidence of unexpected results.

For at least these reasons, claims 8-11, 16-19, 24-27, 32-35 and 40 are patentable over the applied reference. Thus, withdrawal of the rejection under 35 U.S.C. §103(a) is respectfully requested.

II. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 8–11, 16–19, 24–27, 32–35 and 40 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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